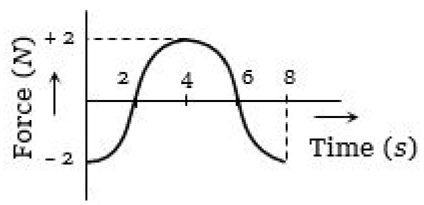
Jupiter Academy

Subjects : Physics | PRACTICE PAPER 03

Total Marks : 180 | (Solutions)

Physics - Section A (MCQ)

1. The force-time $(F - t)$ curve of a particle executing linear motion is as shown in the figure. The momentum acquired by the particle in time interval from zero to 8 second will be .... $N-s$

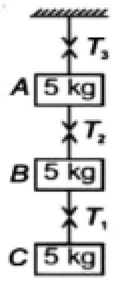


A) -2 **B)** $+4$ **C)** 6 **D)** 0

Solution : (Correct Answer: D)

Momentum acquired by the particle is numerically equal to area enclosed between the $F-t$ curve and time axis. For the given diagram area in upper half is positive and in lower half is negative (and equal to upper half), so net area is zero. Hence the momentum acquired by the particle will be zero.

2. The value of $\frac{T_3}{T_1}$ is ....



A) 1 **B)** 2 **C)** 3 **D)** $\frac{3}{2}$

Solution : (Correct Answer: C)

$a = 0$

$T_1 = 5\,g$

$T_2 - T_1 = 5\,g$

$T_3 - T_2 = 5\,g$

solving the above 3 eq. you get

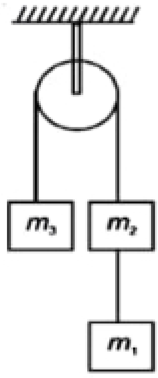
$T_1 = 50$

$T_2 = 100$

$T_3 = 150$

$so \frac{T_3}{T_1} = 3$

3. Three blocks of masses $m_1 = 4\ kg, m_2 = 2\ kg, m_3 = 4\ kg$ are connected with ideal strings passing over a smooth. massless pulley as shown in figure. The acceleration of blocks will be .... m/s^2 $(g = 10\,m/s^2)$



A) 2 **B)** 4 **C)** 3 **D)** 5

Solution : (Correct Answer: A)

We have,

$m_1 = 4\,kg, m_2 = 2\,kg, m_3 = 1\,kg$

So,

$4\,g = 40\,N$ and $2\,g + 4\,g = 6\,g = 60\,N$

So,

$a_{net}(\downarrow) = \frac{f}{n}$

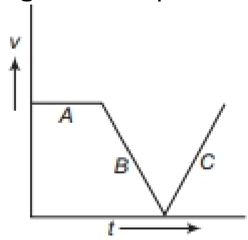
$= \frac{60-40}{10} = \frac{20}{10}$

$= 2\,m/s^2$

Thus, The acceleration of blocks will be

$= 2\,m/s^2$

4. The velocity-time graph of a body is shown in figure. It implies that at point B

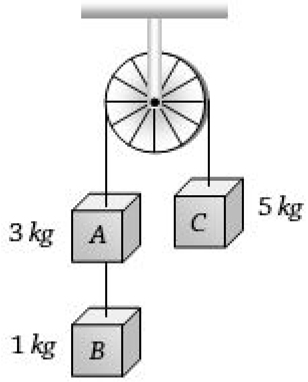


A) the force is zero
B) there is a force towards motion
C) there is a force which opposes motion
D) there is only gravitational force

Solution : (Correct Answer: C)

In region B velocity is decreasing.

5. Three weight A, B and C are connected by string as shown in the figure. The system moves over a frictionless pulley. The tension in the string connecting A and B is (where g is acceleration due to gravity)



A) g B) $\frac{g}{9}$ C) $\frac{8g}{9}$ D) $\frac{10g}{9}$

Solution : (Correct Answer: D)

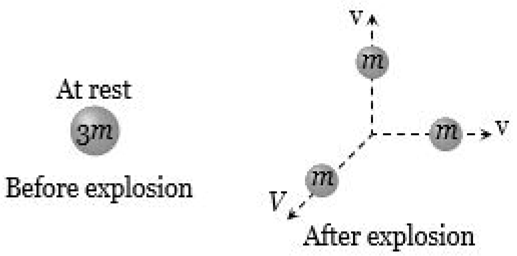
$T = \frac{2\times m_B m_C}{m_A+m_B+m_C} \times g = \frac{2\times1\times5}{3+1+5} \times g = \frac{10}{9}g.$

6. An object of mass $3\ m$ splits into three equal fragments. Two fragments have velocities $v\hat{j}$ and $v\hat{i}$. The velocity of the third fragment is

A) $v(\hat{j}-\hat{i})$ B) $v(\hat{i}-\hat{j})$
C) $-v(\hat{i}+\hat{j})$ D) $\frac{v(\hat{i}+\hat{j})}{\sqrt{2}}$

Solution : (Correct Answer: C)

Initial momentum of $3\,m$ mass $= 0$ ...(i)
Due to explosion this mass splits into three fragments of equal masses.
Final momentum of system = $m\vec{V} + mv\hat{i} + mv\hat{j}$...(ii)
By the law of conservation of linear momentum
$m\vec{V} + mv\hat{i} + mv\hat{j} = 0$==> $\vec{V} = -v(\hat{i}+\hat{j})$



7. A projectile is fired with velocity u at an angle θ with horizontal. At the highest point of its trajectory it splits up into three segments of masses m, m and $2\ m$. First part falls vertically downward with zero initial velocity and second part returns via same path to the point of projection. The velocity of third part of mass $2\,m$ just after explosion will be

A) $u\cos\theta$ B) $\frac{3}{2}u\cos\theta$
C) $2u\cos\theta$ D) $\frac{5}{2}u\cos\theta$

Solution : (Correct Answer: D)

along x-axis no internal force exists, hence momentum will be conserved along x-axis

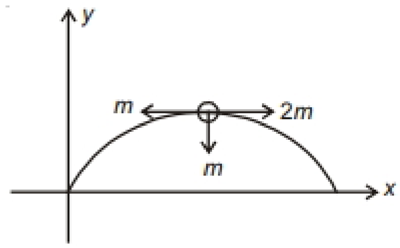
$P_i)_x = P_f)_x$

$(m+m+2m)\cos\theta = -mu\cos\theta + 0 + 2mV$

$\Rightarrow 2mv = 5mu\cos\theta$

$v = \frac{5}{2}u\cos\theta$

and along y direction $P_i)_y = 0$ So $P_f)_y = 0$



8. A man weighing $80\ kg$ is standing in a trolley weighing $320\ kg$. The trolley is resting on frictionless horizontal rails. If the man starts walking on the trolley with a speed of $1\,m/s$, then after $4\ sec$ his displacement relative to the ground will be .... m

A) 5 B) 4.8 C) 3.2 D) 3.0

Solution : (Correct Answer: C)

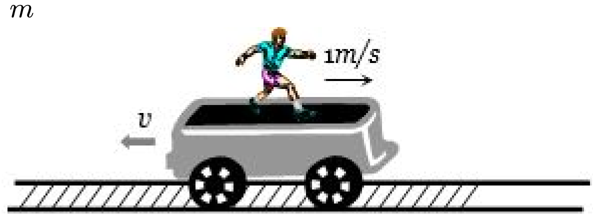
If the man starts walking on the trolley in the forward direction then whole system will move in backward direction with same momentum.

Momentum of man in forward direction = Momentum of system (man + trolley) in backward direction

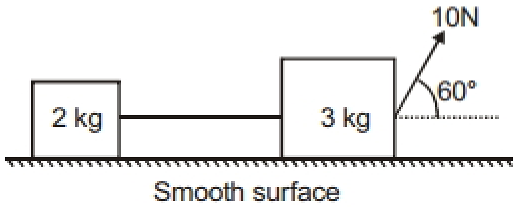
$\Rightarrow 80\times1 = (80+320)\times v \Rightarrow v = 0.2\ m/s$

So the velocity of man w.r.t. ground $1.0 - 0.2 = 0.8\ m/s$

∴ Displacement of man w.r.t. ground $= 0.8\times4 = 3.2\ m$



9. Figure shows two blocks connected by a light inextensible string as shown in figure. A force of $10\ N$ is applied on the bigger block at 60° with horizontal, then the tension in the string connecting the two masses is .... N



A) 5 B) 2 C) 1 D) 3

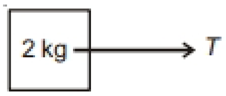
Solution : (Correct Answer: B)

$F_{\text{net}} = Ma$

$(10 \cos 60^{\circ}) = (3+2) a$

$a = 1\, m/s^2$

$T = 2(1) = 2\, N$



10. A dynamometer D is attached to two blocks of masses $6\ kg$ and $4\ kg$ as shown in the figure. The reading of the dynamometer is .... N

A) 18 B) 28 C) 38 D) 48

Solution : (Correct Answer: C)

The tension in the spring will be the reading of dynamometer

$F)_{\text{ext}} = Ma$

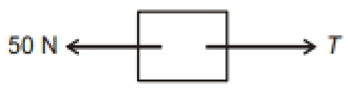
$50 - 30 = 10(a)$

$a = 2\, m/s^2$

for $6\, kg$ block

$50 - T = 6(2)$

$T = 38\, N$



11. A rocket of mass $5700\ kg$ ejects mass at a constant rate of $15\, kg/s$ with constant speed of $12\ km/s$. The acceleration of the rocket 1 minute after the blast is .... m/s^2 $(g = 10\, m/s^2)$

A) 34.9 B) 27.5 C) 3.50 D) 13.5

Solution : (Correct Answer: B)

(b)

$F = \frac{vdm}{dt} - mg \ldots (i)$

where m is mass of the rocket after 1 minute

So

$m = [5700 - 15(60)]$

$= 4800\, kg$

in (i)

$F = \left(12 \times 10^3\right)(15) - (4800) g$

$= (12000)(15) - 48000$

$a = \frac{F}{m} = \frac{12000(15) - 48000}{4800}$

$= 27.5\, m/s^2$

12. When an object is in equilibrium state, then

A) It must be at rest
B) No force is acting on it
C) Its net acceleration must be zero
D) All of these

Solution : (Correct Answer: C)

(c)

Equilibrium $\Rightarrow \vec{F}_{\text{net}} = 0$

Using Newton's second law, $\vec{a} = 0$

13. What force should be applied on the wedge so that block over it does not move? (All surfaces are smooth)

A) $F = (M+m) g \cot \theta$ B) $F = (M+m) g \tan \theta$
C) $F = (M+m) g \sin \theta$ D) $F = (M+m) g \cos \theta$

Solution : (Correct Answer: B)

(b)

$a = \left(\frac{F}{m+M}\right) \ldots \ldots (1)$

$ma \cos \theta = mg \sin \theta$

$a = g \tan \theta$

Put in (1)

$F = (M+m) g \tan \theta$

14. If final momentum is equal to initial momentum of the system then

A) No net force on the system
B) Always net force on the system
C) May be net force on the system
D) Both (a) and (b)

Solution : (Correct Answer: A)

(a)

15. For the system shown in figure, $m_1 > m_2 > m_3 > m_4$. Initially, the system is at rest in equilibrium condition. If the string joining m_4 and ground is cut, then just after the string is cut :

Statement I m_1 ,m_2 ,m_3 remain stationary.

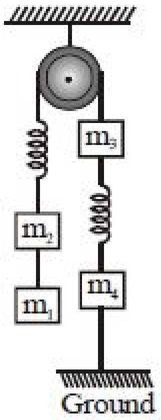
Statement II The value of acceleration of all the 4 blocks can be determined.

Statement III Only m_4 remains stationary.

Statement IV Only m_4 accelerates.

Statement V All the four blocks remain stationary.

Now, choose the correct option.



A) All the statements are correct
B) Only I , II and IV are correct
C) Only II and V are correct
D) Only II and IV are correct.

Solution : (Correct Answer: B)

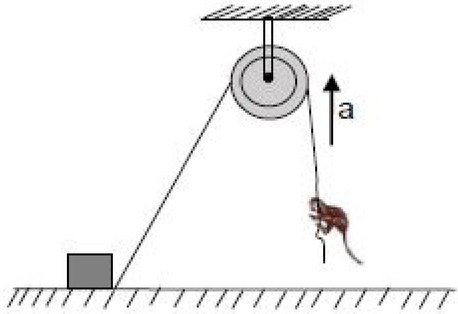
Before cutting the string, the tension in string joining m_4 and ground is $T = (m_1 + m_2 - m_3 - m_4)\, g$

And the spring force in the spring joing m_3 and m_4 is $T - m_4 g$.

As the string is cut, the spring force do not change instantly, so just after cutting the string the equilibrium of m_1, m_2 and $m_3$would be maintained but m_4 accelerates in upward direction with acceleration given by

$a = \frac{T + m_4 g - m_4 g}{m_4}$

16. A light string fixed at one end to a clamp on ground passes over a fixed pulley and hangs at the other side. It makes an angle of 30^o with the ground. A monkey of mass $5\ kg$ climbs up the rope. The clamp can tolerate a vertical force of $40\ N$ only. The maximum acceleration in upward direction with which the monkey can climb safely is .... m/s^2 (neglect friction and take $g = 10\ m/s^2$)



A) 2 B) 4 C) 6 D) 8

Solution : (Correct Answer: C)

Let T be the tension in the string.

The upward force exerted on the clamp $= T \sin 30^\circ = \frac{T}{2}$

$\text{Given: } \frac{T}{2} = 40N \text{ or } T = 80N \qquad ...(i)$

If a is the acceleration of monkey in upward direction,

$a = \frac{T - mg}{m} = \frac{80 - 5 \times 10}{5} = 6 m/s^2$

17. A flexible chain of weight W hangs between two fixed points A & B which are at he same horizontal level. The inclination of the chain with the horizontal at both the points of support is θ . What is the tension of the chain at the mid point?

A) $\frac{W}{2}.cosec\theta$ B) $\frac{W}{2}.tan\theta$
C) $\frac{W}{2}cot\theta$ D) none

Solution : (Correct Answer: C)

$\mathrm{T} \sin \theta = \frac{\mathrm{W}}{2}$

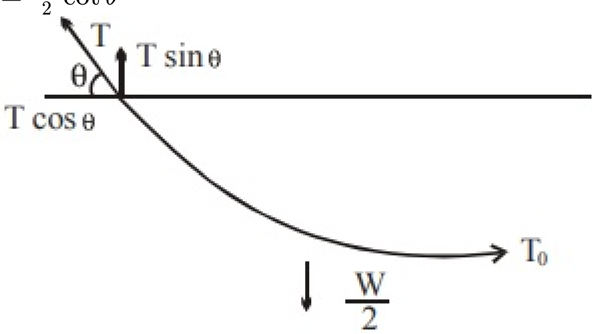
$\therefore \quad \mathrm{T} = \frac{\mathrm{W}}{2 \sin \theta}$

Also, $\mathrm{T} \cos \theta = \mathrm{T}_0$

$\therefore \quad \mathrm{T}_0 = \mathrm{T} \cos \theta$

$\mathrm{T}_0 = \frac{\mathrm{W}}{2 \sin \theta} \cos \theta$

$= \frac{W}{2}\cot\theta$



18. Natural length of a spring is $60\,cm$, and its spring constant is $4000\ N/m$. A mass of $20\ kg$ is hung from it. The extension produced in the spring is,.......cm (Take $g = 9.8\ m/s^2$)

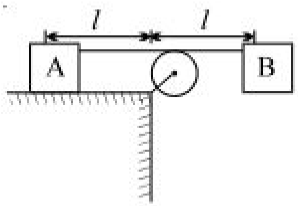
A) 4.9 B) 0.49 C) 9.4 D) 0.94

Solution : (Correct Answer: A)

(a)If x is the extension produced in spring.

$F = kx \Rightarrow x = \frac{F}{k} = \frac{mg}{k} = \frac{20\times9.8}{4000} = 4.9\,cm$

19. Two blocks A and B each of same mass are attached by a thin inextensible string through an ideal pulley. Initially block B is held in position as shown in fig. Now the block B is released. Block A willl slide to right and hit the pulley in time t_A. Block B will swing and hit the surface in time t_B.Assume the surface as frictionless. [Hint: Tension T in the string acting on both blocks is same in magnitude. Acceleration needed for horizontal motion is from T.



A) $t_A = t_B$ B) $t_A < t_B$
C) $t_A > t_B$ D) data are not sufficient to get relationship between t_A and t_B.

Solution : (Correct Answer: B)

Horizontal displacement of both $(= l)$. Horizontal force on A is complete T But horizontal force on B is not complete T. It is component of T. So. horizontal acceleration of B will be less.

$t_A < t_B$

20. A body of mass $2\ kg$ moving on a horizontal surface with an initial velocity of $4\ m/sec$ comes to rest after $2\ sec$. If one wants to keep this body moving on the same surface with a velocity of $4\ m/sec$, the force required is .... N

A) 8 B) 4 C) 0 D) 2

Solution : (Correct Answer: B)

(b) $u = 4\ m/s, v = 0,\ t = 2\,\text{sec}$

$v = u + at \Rightarrow 0 = 4 + 2a \Rightarrow a = -2\,m/s^2$

∴ Retarding force$= ma = 2\times2 = 4\,N$

This force opposes the motion. If the same amount of force is applied in forward

direction, then the body will move with constant velocity.

21. With what minimum acceleration can a fireman slides down a rope while breaking strength of the rope is $\frac{2}{3}$ of his weight

A) $\frac{2}{3}g$ B) g C) $\frac{1}{3}g$ D) Zero

Solution : (Correct Answer: C)

(c) If man slides down with some acceleration then its apparent weight decreases. For critical condition rope can bear only $2/3$ of his weight.

If a is the minimum acceleration then,

Tension in the rope $= m(g-a)$ = Breaking strength

$\Rightarrow m(g-a) = \frac{2}{3}mg$

$\Rightarrow a = g - \frac{2g}{3} = \frac{g}{3}$

22. The weight of man in a lift moving upward is 608 N while the weight of the same man in the lift moving downwards with the same acceleration is $368\,N$. His normal weight is .... N

A) 480 B) 488 C) 588 D) 240

Solution : (Correct Answer: B)

When the lift accelerates at a upwards

$\mathrm{m(g+a)} = 608 \qquad ...(i)$

When the lift accelerates at a downwards

$m(g-a) = 368 \qquad ...(ii)$

From (i) and (ii) we get$a = 2.4\mathrm{m/s^2}$

$m = 49.8\mathrm{kg}$

The normal weight $= \mathrm{mg}$

$w = 49.8\times9.8$

$w = 488\mathrm{N}$

23. A balloon of mass M is descending at a constant acceleration α. When a mass m is released from the balloon it starts rising with the same acceleration α. Assuming that its volume does not change, what is the value of m ?

A) $\left[\frac{\alpha}{\alpha+g}\right]M$
B) $\left[\frac{2\alpha}{\alpha+g}\right]M$

C) $\left[\frac{\alpha+g}{\alpha}\right] M$
D) $\left[\frac{\alpha+g}{2\alpha}\right] M$

Solution : (Correct Answer: B)

Suppose $F =$ upthrust due to buoyancy

Then while descending.

$\mathrm{Mg} - \mathrm{F} = \mathrm{M}\alpha \qquad ...(i)$

when ascending.

$F - (M - m)g = (M - m)\alpha \qquad ...(ii)$

Solving eqn. (i) and eqn. (ii), we get;

$\mathrm{m} = \left[\frac{2\alpha}{\alpha+\mathrm{g}}\right] \mathrm{M}$

24. A balloon of mass m is descending down with an acceleration $\frac{g}{2}$. How much mass should be removed from it so that it starts moving up with same acceleration?

A) $\frac{2\,m}{3}$ B) $\frac{m}{3}$
C) $3\,m$ D) $\frac{4}{3}\,m$

Solution : (Correct Answer: A)

$\Rightarrow mg - F = \frac{mg}{2}$

$F = \frac{mg}{2} \qquad ...(1)$

$\mathrm{F} - (\mathrm{m} - \mathrm{m}_1)\,\mathrm{g} = (\mathrm{m} - \mathrm{m}_1)\,\mathrm{g}/2$

$\mathrm{F} = \frac{3}{2}(\mathrm{m} - \mathrm{m}_1)\,\mathrm{g} \qquad ...(2)$

By equation (1) and (2)

$$\frac{mg}{2} = \frac{3}{2}(m - m_1)\,g$$
$$m = 3m - 3m_1$$
$$3m_1 = 2m$$
$$m_1 = \frac{2m}{3}$$

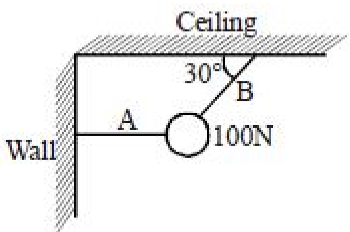
25. A cricket ball of mass $500\ g$ collides with a bat with speed $15\ m/s$ and returns with the same speed within $0.01\ second$. The force acted on bat is .... N

A) 750 B) 1500 C) 500 D) 1000

Solution : (Correct Answer: B)

$\mathrm{F} = \frac{\Delta\mathrm{P}}{\Delta\mathrm{t}} = \frac{0.5(15+15)}{0.01} = 1500\mathrm{N}$

26. A $100\ Newton$ weight is suspended in a corner of a room by two cords A and B as shown in the figure below. The tension in the horizontal cord A is .... N



A) 50 B) 100 C) 200 D) 173.2

Solution : (Correct Answer: D)

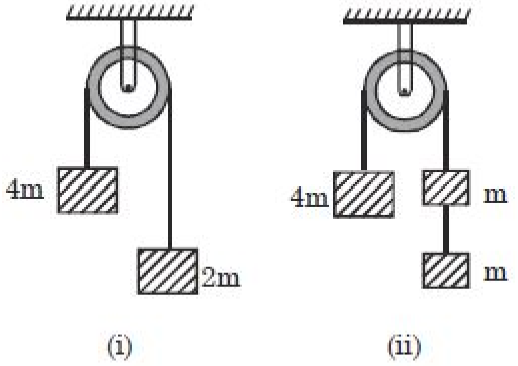
$\mathrm{T_B}\cos 60^\circ = 100$

$\mathrm{T_B} = 200$

$\mathrm{T_B}\sin 60^\circ = \mathrm{T_A}$

$\mathrm{T_A} = 100\sqrt{3} = 173.2\mathrm{N}$

27. In the arrangement shown in figure, pulley is smooth and massles and all the strings are light let F_1 be the force exerted on the pulley in case (i) and F_2 the force in case (ii). Then

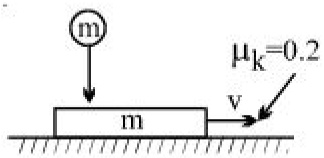


A) $F_1 > F_2$ B) $F_1 < F_2$
C) $F_1 = F_2$ D) $F_1 = 2F_2$

Solution : (Correct Answer: C)

Tension in string directly connected to pulley in both cases are same so force applied on pulley are same.

28. A ball of mass m falls vertically from a height h and collides with a block of equal mass m moving horizontally with a velocity v on a surface. The coefficient of kinetic friction between the block and the surface is 0.2, while the coefficient of restitution e between the ball and the block is 0.5. There is no friction acting between the ball and the block. The velocity of the block decreases by



A) 0 B) $0.1\sqrt{2gh}$
C) $0.3\sqrt{2gh}$ D) can't be said

Solution : (Correct Answer: D)

By using change in impulse formula $\Delta p = F\Delta t$

$= \frac{3}{2}m\sqrt{2gh}$

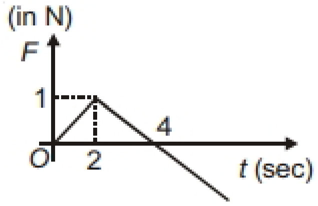
where as on black

$\mu F\Delta t = mv - mv^1$

$0.2 \times \frac{3}{2}\sqrt{2gh} \times m = m\left(v - v^1\right)$

$\therefore \left(v - v^1\right) = 0.3\sqrt{2gh}$

29. Force acting on a body varies with time as shown below. If initial momentum of the body is $\vec{p}$, then the time taken by the body to retain its momentum $\vec{p}$ again is .... s



A) 8
B) $(4+2\sqrt{2})$
C) 6
D) Can never obtain

Solution : (Correct Answer: B)

$\tan\theta = \frac{1}{2} = \frac{F_0}{t_0-4}$

$\Rightarrow F_0 = \frac{t_0-4}{2}$

Total change in momentum should be zero, then only it will retain its initial momentum.

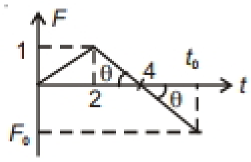
So, positive area of $F-t$ curve should be equal to negative area of $F-t$ curve till time t_0.

$\frac{1}{2}(4)(1) = \frac{1}{2}(t_0-4)F_0$

$8 = \frac{(t_0-4)}{2}\cdot\frac{(t_0-4)}{2}$

$(t_0-4)^2 = 32$

$t_0 = 4+2\sqrt{2}$



30. A constant force acting on a body of mass of $5\ kg$ changes its speed from $5\ ms^{-1}$ to $10\ ms^{-1}$ in $10\ s$ without changing the direction of motion. The force acting on the body is .... N

A) 1.5
B) 2
C) 2.5
D) 5

Solution : (Correct Answer: C)

$a = \frac{v-u}{t} = \frac{(10-5)ms^{-1}}{10s} = 0.5\mathrm{ms}^{-2}$

As $\mathrm{F} = \mathrm{ma}$

$\therefore \mathrm{F} = (5\mathrm{kg})(0.5\mathrm{ms}^{-2}) = 2.5\mathrm{N}$

31. When an object is at rest

A) Force is required to keep it in rest state
B) No force is acting on it
C) A large number of forces may be acting on it which balance each other
D) It is in vacuum

Solution : (Correct Answer: C)

(c)

Object can be at rest only if net force acting on it is zero.

$\vec{F}_{\text{net}} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4 + \ldots\ldots\ldots \vec{F}_n = 0$

32. An initially stationary device lying on a frictionless floor explodes into two pieces and slides across the floor one piece is moving in positive x direction then other peice is moving in

A) Positive y direction
B) Negative y direction
C) Negative x direction
D) At angle from x direction

Solution : (Correct Answer: C)

(c)

Since first part is moving positive x

$\therefore$ Second part will confirm move in negative.

$\therefore$ Option C is correct.

33. A ping-pong ball of mass m is floating in air by a jet of water emerging out of a nozzle. If the water strikes the ping-pong ball with a speed v and just after collision water falls dead, the rate of flow (in kg/s) of water in the nozzle is equal to

A) $\frac{2mg}{v}$
B) $\frac{mv}{g}$
C) $\frac{mg}{v}$
D) none of these

Solution : (Correct Answer: C)

The impact force,

$\mathrm{F} = \frac{\Delta \mathrm{p}}{\Delta \mathrm{t}}$

Where $\Delta P =$ change of momentum of water of mass $\Delta\mathrm{m}$ striking the pendulum with speed v during time Δt.

since water falls dead after collision with the

ping-pong ball.

$\Delta\mathrm{p} = \Delta\mathrm{mv}$

or $\quad \mathrm{F} = \mathrm{v}\frac{\Delta\mathrm{m}}{\Delta\mathrm{t}}$

Where $\frac{\Delta\mathrm{m}}{\Delta\mathrm{t}} =$ rate of flow of water in the nozzle since, the ball is in equilibrium,

$\mathrm{F} - \mathrm{mg} = 0 \quad \text{or} \quad \mathrm{F} = \mathrm{mg}$

$\mathrm{v}\frac{\Delta\mathrm{m}}{\Delta\mathrm{t}} = \mathrm{mg}$

or $\quad \frac{\Delta\mathrm{m}}{\Delta\mathrm{t}} = \frac{\mathrm{mg}}{\mathrm{v}}$

34. Displacement of a particle of mass $2\ kg$ moving in a straight line varies with time as $s = (2t^3+2)$ m. Impulse of the force acting on the particle over a time interval between $t=0$ and $t=1\ s$ is .... $N-s$

A) 10 B) 12 C) 8 D) 6

Solution : (Correct Answer: B)

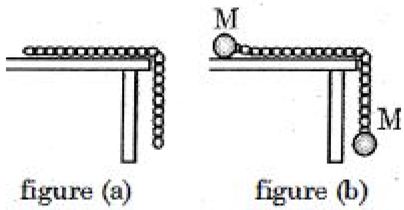
$v = \frac{ds}{dt} = 6t^2$

Impulse $= \Delta P = m(v_f - v_i) = 2(6 \times 1 - 0) = 12N - s$

35. A chain lying on an absolutely smooth table, half of it hanging over the edge of the table as shown in figure (a). The time it takes to slip off the table is affected if two equal weights be attached, one to each end as shown in figure (b) .

t_a : time taken to slip in situation $'a'$

t_b : time taken to slip in situation $'b'$

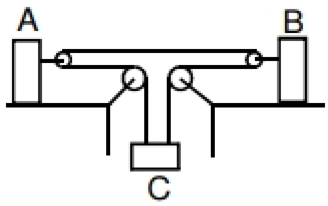


A) $t_a > t_b$ B) $t_a < t_b$

C) $t_a = t_b$ D) cannot be determined

Solution : (Correct Answer: B)

36. If acceleration of A is $2\ m/s^2$ to left and acceleration of B is $1\ m/s^2$ to left, then acceleration of C is -



A) $1\,m/s^2$ upwards

B) $1\,m/s^2$ downwards

C) $2\,m/s^2$ downwards

D) $2\,m/s^2$ upwards

Solution : (Correct Answer: A)

From constrained

$-a_c + 2 + 2 - 1 - 1 - a_c = 0$

$a_c = 1\,m/s^2 \uparrow$

37. A rope of length L is pulled by a constant force F. What is the tension in the rope at a distance x from the end where the force is applied

A) $\frac{FL}{x}$ B) $\frac{F(L-x)}{L}$

C) $\frac{FL}{L-x}$ D) $\frac{Fx}{L-x}$

Solution : (Correct Answer: B)

$a = \frac{F}{M}$

Mass per unit length $\lambda = \frac{M}{l}$

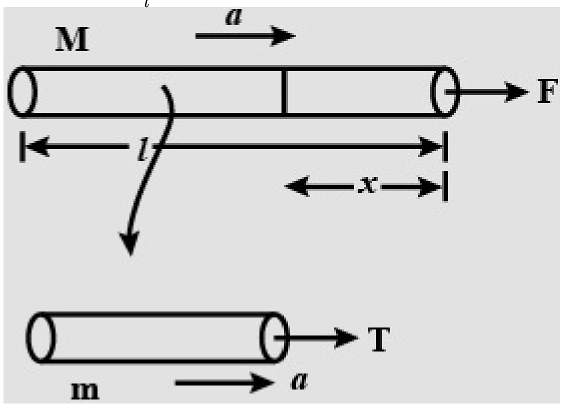
Hence mass of the part of length $(l-x)$ is given by $m = \lambda(l-x)$

$\Longrightarrow m = \frac{M(l-x)}{l}$

For this part–

$T = ma = \frac{M(l-x)}{l} \times \frac{F}{M}$

$\Longrightarrow T = \frac{F(l-x)}{l}$



38. An aircraft is moving with a velocity of $300\ ms^{-1}$. If all the forces acting on it are balanced, then

A) It still moves with the same velocity

B) It will be just floating at the same point in space

C) It will fall down instantaneously

D) It will lose its velocity gradually

Solution : (Correct Answer: A)

$F = ma$

If the forces are balanced, $F = 0$, which implies $a = 0$. If there's no acceleration, then the velocity is constant. The solutions are trajectories of constant velocity, which means the aircraft will move along a straight line with uniform speed.

39. A ball of mass $150\ g$ starts moving with an acceleration of $20 m/s^2$. When hit by a force, which acts on it for $0.1\ sec$. The impulsive force is .... $N-s$

A) 0.5 B) 0.1 C) 0.3 D) 1.2

Solution : (Correct Answer: C)

(c) Impulse $=$ Force $\times$ time = $m \times a \times t = 0.15 \times 20 \times 0.1 = 0.3\,N{-}s$

40. A body of mass m collides against a wall with a velocity v and rebounds with the same speed. Its change of momentum is

A) $2\,mv$ B) mv C) $-mv$ D) Zero

Solution : (Correct Answer: A)

(a)$\Delta p = p_i - p_f = mv - (-mv) = 2\,mv$

41. A rider on horse back falls when horse starts running all of a sudden because

A) Rider is taken back

B) Rider is suddenly afraid of falling

C) Inertia of rest keeps the upper part of body at rest whereas lower part of the body moves forward with the horse

D) None of the above

Solution : (Correct Answer: C)

(c) Visualize the horse and man as part of the same system with the man as the upper part and horse as the lower part. When the horse moves, lower part starts to move but due to inertia the upper part wants to remain at rest.

42. A man of weight $75\ kg$ is standing in an elevator which is moving with an acceleration of $5\ m/s^2$ in upward direction the apparent weight of the man will be .... N $\quad (g = 10\ m/s^2)$

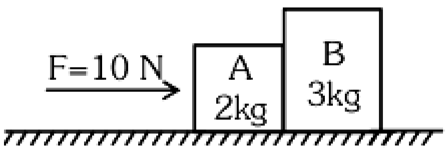
A) 1425 B) 1375 C) 1250 D) 1125

Solution : (Correct Answer: D)

(d)The apparent weight,

$R = m(g + a) = 75(10 + 5) = 1125\ N$

43. A horizontal force $10\ \mathrm{N}$ is applied to a block A as shown in figure. The mass of blocks A and B are $2\ \mathrm{kg}$ and $3\ \mathrm{kg}$ respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is :



A) $4\ \mathrm{N}$ B) $6\ \mathrm{N}$ C) $10\ \mathrm{N}$ D) Zero

Solution : (Correct Answer: B)

$F = (M_1 + M_2)\, a$

$a = \frac{10}{2+3} = 2\ \mathrm{ms}^{-2}$

$F' = M_2(2) = 3 \times 2\ \mathrm{N} = 6\ \mathrm{N}$

44. A person standing on the floor of an elevator drops a coin. The coin reaches the floor in time t_1 if the elevator is at rest and in time t_2 if the elevator is moving uniformly. Then

A) $\mathrm{t}_1 < \mathrm{t}_2$ or $\mathrm{t}_1 > \mathrm{t}_2$ depending upon whether the lift is going up or down

B) $\mathrm{t}_1 < \mathrm{t}_2$

C) $\mathrm{t}_1 > \mathrm{t}_2$

D) $\mathrm{t}_1 = \mathrm{t}_2$

Solution : (Correct Answer: D)

$\mathrm{t} = \sqrt{\frac{2\mathrm{h}}{\mathrm{a}_{\mathrm{real}}}}$

In both cases $a_{\mathrm{real}} = \mathrm{g} - 0 = g$,

Hence $t_1 = t_2$

45. A person is standing in an elevator. In which situation he finds his weight less than actual when

A) The elevator moves upward with constant acceleration

B) The elevator moves downward with constant acceleration.

C) The elevator moves upward with uniform velocity

D) The elevator moves downward with uniform velocity

Solution : (Correct Answer: B)

(b) When elevator moves downward with constant acceleration, $a = g$. Then person

standing in an elevator find himself weightless.

$(g'$ with respect to the lift is $(g - a))$